LAB GUIDE



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BFD Lab1 – eBGP

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Important!

This guide assumes that the AOS-CX ova has been installed and works in GNS3 or EVE-NG. Please refer to GNS3/EVE-NG initial setup labs if required. https://www.eve-ng.net/index.php/documentation/howtos/howto-add-aruba-cx-switch/

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At this time, EVE-NG does not support exporting/importing AOS-CX startup-config. The lab user should copy/paste the AOS-CX node configuration from the lab guide as described in the lab guide if required.

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Lab Objective

This lab will enable the reader to gain hands-on experience with configuring BFD on BGP and testing associated benefits on the network high-availability.

BFD reminder

- Bidirectional Forwarding Detection is a standard general-purpose fast failure detection mechanism.
- After a BFD session is established, if no BFD control packet is received from the peer within the negotiated BFD interval, BFD notifies a failure to the protocol consuming the BFD service, which then takes appropriate action (like tearing down BGP session, and consequently clearing the routes).
- On AOS-CX, BFD operates in asynchronous mode: BFD control packets are send periodically to the peer. If the other device does not receive BFD control packet from the peer within the specified interval, it tears down the BFD session.
- Failure detection is unidirectional. The local node uses BFD control message to notify the peer that a BFD failure was detected.
- Echo is a function that consists in looping back the received echo message to the sender without processing it. If the sender does not receive its echo message back, BFD tears down the session. This task is accelerated in the ASIC, alleviating the CPU load for BFD control messages, as the rate of the control message can be lower. No delay of processing. It must be implemented in each direction. Echo function is not available on AOS-CX Simulator.
- IPv6 transport of BFD is supported on the AOS-CX Simulator.
- BFD should be used only for non-direct point-to-point peering, typically when a 3rd device is inserted between the peers. This 3rd device can be a L2 switch or a L1 optical switch not mirroring the state between physical ports.
- Most of the time, BFD is not useful for BGP peering over a direct point-to-point L3 circuit:
 - For **eBGP**, **fast-external failover** will ensure that if the peering circuit fails, all the routes learnt behind the next-hop attached to the failed circuit will immediately get withdrawn (in milliseconds).
 - For iBGP, neighbor fall-over command without bfd extension, will force route withdrawn based on the nexthop reachability status in OSPF. As the link connecting the peer fails, OSPF will immediately withdraw Loopback routes and notify BGP protocol which will do the same within milliseconds.
- When enabling BFD for BGP, the objective is to track the availability of the physical links being monitored and not the reachability of the loopback. Consequently, the loopback address must not be used as BGP peering IP address. It is not suitable for:
 - iBGP (traditionally peering over loopbacks)
 - eBGP multihop (TTL>1)

Lab Overview

This lab guide explains how to configure BFD (Bidirectional Forwarding Detection) on AOS-CX switch with eBGP.

As a prerequisite, please read the BFD section of the <u>ArubaOS-CX High Availability Guide</u> (https://www.arubanetworks.com/techdocs/AOS-CX/10.07/HTML/5200-7854/Content/fir-int.htm).

During this lab, you'll be able to:

- Configure eBGP over parallel paths and BGP weight as BGP criteria for best routes election
- Test traffic and path selection in nominal situation and also in failure condition.
- Configure BFD
- Check improvement on high-availability.

The minimum required AOS-CX Switch Simulator version for this la	ab is 10.6. It is recommended to use release 10.07.0010 or
later.	· · · · · · · · · · · · · · · · · · ·

This lab uses EVE-NG but GNS3 can be used as well.

Other BFD labs will be proposed like tracing and debugging BFD.





10.10.100.11/24

Lab Tasks

Task 1 – Lab setup

- In EVE-NG, import the .zip lab file containing the "unl" file.
 All the connections between nodes are already set-up. Appropriate numbers of CPUs (2), RAM (4096 MB) and interfaces are already allocated.
- Check the connectivity as proposed above.
- Start all the devices (3 AOS-CX switches and 1 host)
- Open each switch console and log in with user "admin".
 The switches will ask to enter a new password. This new password can be an empty password for simplicity in this lab.
- Apply (copy/paste) the baseline configuration as proposed below

baseline configuration proposal (for initial copy/paste):	
SW1	SW2
hostname SW1	hostname SW2
1	!
vlan 1	vlan 1
vlan 1105	vlan 1105
description transit interco VLAN	description transit interco VLAN
interface mgmt	interface mgmt
no shutdown	no shutdown
ip dhcp	ip dhcp

Baseline configuration proposal (for initial copy/paste):

	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
interface 1/1/8	• • • • interface 1/1/1 • • • • • • •
no shutdown	no shutdown
description link to SW3	description to SW3
ip address 192.168.4.0/31	• • • • • no routing • • • • • • • •
interface 1/1/9	vlan access 1105
no shutdown	interface 1/1/9
description link to SW2	no shutdown
no routing	description to SW1
vlan access 1105	no routing
interface loopback 0	vlan access 1105
ip address 192.168.2.1/32	interface vlan 1105
interface vlan 1105	ip address 192,168,4,11/29
ip address 192,168,4,9/29	
1p ddd1000 192.100.1.9/29	

HostA

VPCS> ip 10.10.100.11/24 10.10.100.1

SW3

hostname SW3 1 vlan 1,100 vlan 1105 description transit interco VLAN interface mgmt no shutdown ip dhcp interface 1/1/1 no shutdown description link to HostA no routing vlan access 100 interface 1/1/8 no shutdown description to SW1 ip address 192.168.4.1/31 interface 1/1/9 no shutdown description to SW2 no routing vlan access 1105 interface loopback 0 ip address 192.168.2.2/32 interface vlan 100 ip address 10.10.100.1/24 interface vlan 1105 ip address 192.168.4.12/29

• Verify the connectivity through LLDP neighbor information as follows:

SWI											
SW1# show lldp neighbor-info											
LLDP Neighbor Information											
Total Neighbor Entries: 2Total Neighbor Entries Deleted: 0Total Neighbor Entries Dropped: 0Total Neighbor Entries Aged-Out: 0											
LOCAL-PORT CHASSIS-ID PORT-ID	PORT-DESC	TTL	SYS-NAME								
1/1/8 08:00:09:5b:7e:2d 1/1/8	link to SW1	120	SW3								
1/1/9 08:00:09:54:97:83 1/1/9	link to SW1	120	SW2								
SW2											
SW2# show lldp neighbor-info											
LLDP Neighbor Information											
Total Neighbor Entries : 2											
Total Neighbor Entries Deleted : 0											
Total Neighbor Entries Dropped : 0											

	1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0		
	• •	Config	BFD Lab1 uration and HA test
Total Neighbor Entries Aged-Out : 0			
LOCAL-PORT CHASSIS-ID PORT-ID	PORT-DESC	TTL	SYS-NAME
1/1/1 08:00:09:5b:7e:2d 1/1/9 1/1/9 08:00:09:d7:5f:0f 1/1/9	link to SW2 link to SW2	120 120	SW3 SW1
SW3			
SW3# show lldp neighbor-info	· · · · · · · · · · · · · · · · · · ·		
LLDP Neighbor Information			0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
Total Neighbor Entries : 2	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0		
Total Neighbor Entries Deleted : 2 Total Neighbor Entries Dropped : 0			
Total Neighbor Entries Aged-Out : 2			
LOCAL-PORT CHASSIS-ID PORT-ID	PORT-DESC	TTL	SYS-NAME
1/1/8 08:00:09:d7:5f:0f 1/1/8	link to SW3	120	SW1
1/1/9 08:00:09:54:97:83 1/1/1	link to SW3	120	SW2
Verify the IP connectivity with ping from	SW1 to SW2 and SW3, from SW2 to SW1 and	SW3, from S	W3 to SW1 (some
sw1			
<pre>108 bytes from 192.168.4.1: icmp_seq=1 108 bytes from 192.168.4.1: icmp_seq=2 108 bytes from 192.168.4.1: icmp_seq=3 108 bytes from 192.168.4.1: icmp_seq=4 108 bytes from 192.168.4.1: icmp_seq=5 192.168.4.1 ping statistics 5 packets transmitted, 5 received, 0% p rtt min/avg/max/mdev = 2.148/2.499/2.94 SW1# ping 192.168.4.11 PING 192.168.4.11 (192.168.4.11) 100(12 108 bytes from 192.168.4.11: icmp_seq=1 108 bytes from 192.168.4.11: icmp_seq=3 108 bytes from 192.168.4.11: icmp_seq=3 108 bytes from 192.168.4.11: icmp_seq=3 108 bytes from 192.168.4.11: icmp_seq=5 192.168.4.11 ping statistics 5 packets transmitted, 5 received, 0% p rtt min/avg/max/mdev = 2.092/2.583/3.26 SW1# ping 192.168.4.12 PING 192.168.4.12 (192.168.4.12) 100(12 108 bytes from 192.168.4.12: icmp_seq=3 108 bytes from 192.168.4.12: icmp_seq=4 108 bytes from 192.168.4.12: icmp_seq=4 108 bytes from 192.168.4.12: icmp_seq=3 108 bytes from 192.168.4.12: icmp_seq=4 108 bytes from 192.168.4.12: icmp_seq=3 108 bytes from 192.168.4.12: icmp_seq=4 108 bytes from 192.168.4.12: icmp_seq=5 192.168.4.12: icmp_seq=3 108 bytes from 192.168.4.12: icmp_seq=4 108 bytes from 192.168.4.12: icmp_seq=3 108 bytes from 192.168.4.12: icmp_seq=5 192.168.4.12: ping statistics </pre>	<pre>ttl=64 time=2.51 ms ttl=64 time=2.51 ms ttl=64 time=2.15 ms ttl=64 time=2.17 ms ttl=64 time=2.94 ms Dacket loss, time 4000ms 28) bytes of data ttl=64 time=3.26 ms 2 ttl=64 time=2.63 ms 3 ttl=64 time=2.40 ms 4 ttl=64 time=2.54 ms 5 ttl=64 time=2.09 ms Dacket loss, time 4003ms 20/0.383 ms 28) bytes of data ttl=64 time=4.89 ms 2 ttl=64 time=4.16 ms 3 ttl=64 time=3.95 ms 5 ttl=64 time=4.02 ms </pre>		
5 packets transmitted, 5 received, 0% p rtt min/avg/max/mdev = 3.946/5.066/8.15	packet loss, time 4004ms 56/1.580 ms		
SW2			
SW2# ping 192.168.4.9 PING 192.168.4.9 (192.168.4.9) 100(128) 108 bytes from 192.168.4.9: icmp_seq=1 108 bytes from 192.168.4.9: icmp_seq=2 108 bytes from 192.168.4.9: icmp_seq=3 108 bytes from 192.168.4.9: icmp_seq=4 108 bytes from 192.168.4.9: icmp_seq=5	bytes of data. ttl=64 time=2.39 ms ttl=64 time=2.46 ms ttl=64 time=2.62 ms ttl=64 time=2.15 ms ttl=64 time=2.54 ms		

BFD Lab1 Configuration and HA test --- 192.168.4.9 ping statistics ---5 packets transmitted, 5 received, 0% packet loss, time 4006ms rtt min/avg/max/mdev = 2.146/2.430/2.621/0.162 ms SW2# ping 192.168.4.12 PING 192.168.4.12 (192.168.4.12) 100(128) bytes of data. 108 bytes from 192.168.4.12: icmp_seq=1 ttl=64 time=2.24 ms 108 bytes from 192.168.4.12: icmp seq=2 ttl=64 time=2.50 ms 108 bytes from 192.168.4.12: icmp seq=3 ttl=64 time=2.38 ms 108 bytes from 192.168.4.12: icmp seq=4 ttl=64 time=1.85 ms 108 bytes from 192.168.4.12: icmp_seq=5 ttl=64 time=2.92 ms --- 192.168.4.12 ping statistics ---5 packets transmitted, 5 received, 0% packet loss, time 4004ms rtt min/avg/max/mdev = 1.853/2.376/2.922/0.347 ms SW3 SW3# ping 192.168.4.0 PING 192.168.4.0 (192.168.4.0) 100(128) bytes of data. 108 bytes from 192.168.4.0: icmp seq=1 ttl=64 time=2.17 ms 108 bytes from 192.168.4.0: icmp_seq=2 ttl=64 time=2.37 ms 108 bytes from 192.168.4.0: icmp seq=3 ttl=64 time=2.10 ms 108 bytes from 192.168.4.0: icmp_seq=4 ttl=64 time=2.24 ms 108 bytes from 192.168.4.0: icmp seq=5 ttl=64 time=2.62 ms --- 192.168.4.0 ping statistics ---5 packets transmitted, 5 received, 0% packet loss, time 4004ms rtt min/avg/max/mdev = 2.098/2.299/2.622/0.184 ms SW3# ping 192.168.4.9 PING 192.168.4.9 (192.168.4.9) 100(128) bytes of data. 108 bytes from 192.168.4.9: icmp seq=1 ttl=64 time=3.61 ms 108 bytes from 192.168.4.9: icmp seq=2 ttl=64 time=2.94 ms 108 bytes from 192.168.4.9: icmp_seq=3 ttl=64 time=3.45 ms 108 bytes from 192.168.4.9: icmp_seq=4 ttl=64 time=3.93 ms 108 bytes from 192.168.4.9: icmp_seq=5 ttl=64 time=3.98 ms --- 192.168.4.9 ping statistics ---5 packets transmitted, 5 received, 0% packet loss, time 4003ms rtt min/avg/max/mdev = 2.937/3.579/3.980/0.377 ms Verify the IP connectivity between HostA and SW3 L0: ٠ HostA

84 bytes from 192.168.2.2 icmp_seq=1 ttl=64 time=1.504 ms 84 bytes from 192.168.2.2 icmp_seq=2 ttl=64 time=1.149 ms 84 bytes from 192.168.2.2 icmp_seq=3 ttl=64 time=1.338 ms 84 bytes from 192.168.2.2 icmp_seq=4 ttl=64 time=1.511 ms 84 bytes from 192.168.2.2 icmp_seq=5 ttl=64 time=1.500 ms

Task 2 – Configure BGP routing

The objective of this task is to allow IP connectivity between HostA subnet and SW1 Loopback0. For this purpose, eBGP is used between SW1 and SW3. As there are 2 data paths, BGP weight will be used as selection criteria between the backup path (direct L3 link) and the main path which is through the intermediate L2 switch. Default VRF is used in this lab.

Step #1: Configure BGP

VPCS> ping 192.168.2.2

SW1 runs BGP Autonomous-System 65001, and Loopback0 is redistributed in BGP.

SW2 runs BGP Autonomous-System 65002, Loopback0 is redistributed in BGP as well as connected subnets that are redistributed based on ip prefix-list match.

	 0
SW1(config)#	SW3(config)#
<pre>router bgp 65001 bgp router-id 192.168.2.1 bgp fast-external-fallover neighbor 192.168.4.1 remote-as 65002 neighbor 192.168.4.1 weight 200 neighbor 192.168.4.12 remote-as 65002 neighbor 192.168.4.12 weight 300 neighbor 192.168.4.12 timers 10 30 address-family ipv4 unicast neighbor 192.168.4.1 activate neighbor 192.168.4.1 activate redistribute local loopback exit-address-family</pre>	<pre>ip prefix-list endpoint seq 10 permit 10.0.0.0/8 le 32 ! route-map connected-bgp permit seq 10 match ip address prefix-list endpoint ! router bgp 65002 bgp router-id 192.168.2.2 bgp fast-external-fallover neighbor 192.168.4.0 remote-as 65001 neighbor 192.168.4.9 remote-as 65001 neighbor 192.168.4.9 weight 300 neighbor 192.168.4.9 timers 10 30 address-family ipv4 unicast neighbor 192.168.4.9 activate redistribute local loopback redistribute connected route-map connected- bgp exit-address-family</pre>

<u>Note</u>: the BGP timers for BGP sessions over the L2 intermediate node has been reduced here for minimizing recovery time during the lab. In production, default BGP timer values can be used as BFD would be used to protect session over intermediate L2 node.

Step #2: Verify BGP sessions

SW1		
SW1# show bgp ipv4 unic VRF : default GP Summary	ast summary	
Local AS Peers Cfg. Hold Time Confederation Id	: 65001 BGP R : 2 Log N : 180 Cfg. : 0	Couter Identifier : 192.168.2.1 Weighbor Changes : No Keep Alive : 60
Neighbor Remote 192.168.4.1 65002 192.168.4.12 65002	-AS MsgRcvd MsgSent 74 74 74 76	Up/Down Time State AdminStatus O0h:10m:03s Established Up O0h:10m:03s Established Up
SW1# show bgp ipv4 unic Codes: ^ Inherited from	ast neighbors 192.168 peer-group	2.4.12
<pre>VRF : default BGP Neighbor 192.168.4. Description Peer-group</pre>	12 (External) : :	
Remote Router Id Remote AS Remote Port State Conn. Established Passive Cfg. Hold Time Neg. Hold Time Up/Down Time Local-AS Prepend BFD Password Last Err Sent Last SubErr Sent Last Err Royd	: 192.168.2.2 : 65002 : 179 : Established : 1 : No : 30 : 00h:08m:08s : No : Disabled : : No Error : No Error : No Error	Local Router Id : 192.168.2.1 Local AS : 65001 Local Port : 44486 Admin Status : Up Conn. Dropped : 0 Update-Source : Cfg. Keep Alive : 10 Neg. Keep Alive : 10 Connect-Retry Time : 120 Alt. Local-AS : 0
	-	

								:					В	FD	Lab)1				
				• •			• •	•		C	onfig	urati	on ar	nd H	A te	st				
				• •	• • •	• • •	• •	• •												
Table California David	N			• •			• •	• •												
Last Suberr RCVd	: NO Error																			
							• •	• •	•											
Graceful-Restart	: Enabled		Gr. Restart Time	• •	120		• •	• •	• •											
Gr. Stalepath Time	: 300		Remove Private-AS	•••1	No	• • •	• •	• •	• •											
TTL	: 1		Local Cluster-ID				::	•••	•••											
Weight	: 300		Fall-over	: 1	No			• •												
Confederation-Peers	: No			• •			• •	• •	• •											
				• •	• • •	• • •	• •	• •	• •	• • •										
Message statistics	Sent	Rcvd		•••	•••	•••	•••	•••	•••	•••	•									
Open	1	1		• •			• •	• •	• •											
Notification	0	0		• •	• • •	• • •	• •	• •	• •		• • •	• • •	•							
Undates	5	о Д	` • • • • • • •	•••	•••	•••	•••	•••	• •	•••	• • •	•••	•••	•						
Keepaliyes	58	55													•••					
Reeparives	50	55					• •	• •	• •				• •	• •		• •	• •			
Route Reffesh	0	60		• •			• •	• •	• •		• • •		• •	• •	• •	• •	• •	• •	• •	
TOTAL	64	60	• • • •	•••	• • •	•••	•••	••	• • •	• • •	• • •		• •	•••	• • •	•••	• •	•••	•••	
Capability		Adv	ertised Receiv	ed			• •	• •						• •		• •	• •	• •		
					•••		• •	• •	• •		• • •		• •	• •	• •	••	• •	• •	• •	•
Route Refresh		Yes	Yes	•••	• • •	•••	•••	••	• •	•••	• • •	•••	• •	•••	• •	•••	•••	•••	•••	•
Graceful Restart		Yes	Yes																	
Add-Path		No	No		•		• •	• •					• •	• •		• •	• •	• •	• •	•
Four Octet ASN		Yes	Yes		-	• • •	• •	• •	• •		• • •	• • •	• •	• •	• •	••	• •	• •	• •	•
Address family IPv4	Unicast	Yes	Yes				•••	•••	• • •	• • •	• • •	•••	••	•••	• • •	•••	•••	•••	•••	•
Address family IPv6	Unicast	No	No				•••													
Address family L2VP	N EVPN	No	No					•					• •	• •		• •	• •	• •		•
_									• •		• • •	• • •	• •	• •	• •	••	• •	• •	• •	•
Address Familv : IP	v4 Unicast										• • •	•••	••	•••	•••	•••	•••	•••	•••	
													• •	• •		• •	• •			
Rt Reflect Client	• No		Send Community										* •	• •	• •	• •	• •	• •	• •	•
Allow-AS in	• 0		Advt Interval	:	30										•	••	• •	•••	•••	•
AIIOW-AS III Mare Draffin	. 0		Advt. Interval	•	50														•••	
Max. Prelix	: 64000		Solt Reconlig in	:																
Nexthop-Self	:		Default-Originate	:																
Cig. Add-Path	:																			
Neg. Add-Path	: Disable																			
Routemap In	:																			
Routemap Out	:																			
ORF type	: Prefix-list																			
ORF capability	:																			

The BGP timer values displayed in the summary are the values for the global BGP timers (default 60s/180s).

Note: BFD is not yet enabled at this stage of the lab.

SW3	
SW3# show bgp ipv4 unicast summary	
VRF : default	
BGP Summary	
Local AS : 65002	BGP Router Identifier : 192.168.2.2
Peers : 2	Log Neighbor Changes : No
Cfg. Hold Time : 180	Cfg. Keep Alive : 60
Confederation Id : 0	
Malakara Danaka 20 Marpada M	
Neighbor Remote-AS MsgRcva Ms	sgSent Up/Down Time State Administatus
192.168.4.9 65001 81	78 00h:10m:37s Established Up
SW3# show bgp ipv4 unicast neighbors	192.168.4.9
codes: innericed from peer-group	
VRF : default	
BGP Neighbor 192.168.4.9 (External)	
Description :	

						Configuration and HA test	
					• • • • • • • • •	5	
D				• • • •	• • • • • • • • • • •		
Peer-group	:			••••			
Remote Router Id	: 192.168.2.1		Local Router Id	1	192.168.2.2		
Remote AS	: 65001		Local AS • • • •	••••	•65002••••••		
Remote Port	: 44486		Local Port	••••	179		
State	: Established		Admin Status		αU		
Conn Established	• 1		Conn Dropped		0		
Deceive	• 1		Undate Course			• • .	
Passive	: NO		opuale-source		• • • • • • • • • • • • •	• • • x	
Cig. Hold Time	: 30		Cig. Keep Alive	••••	10	• • • • <	
Neg. Hold Time	: 30		Neg. Keep Alive	•••	10	• • • • • .	
Up/Down Time	: 00h:11m:07s		Connect-Retry T	lime :	120	• • • • • • •	
Local-AS Prepend	: No		Alt. Local-AS		0		
BFD	: Disabled						
Password	•						
14550014	•						
			• • •		• • • • • • • • • • • • •		
Last Err Sent	: No Error		• •	• • • •			
Last SubErr Sent	: No Error						
Last Err Rcvd	: No Error						
Last SubErr Rcvd	: No Error						
Graceful-Postart	• Enabled		Gr Rostart Tim		120		
Gracerur Restart	. 200		Demons Deduction		120		• • • • •
Gr. Starepath Time	: 500		Remove Private-	-A5 :			• • • • •
TTL	: 1		Local Cluster-1	LD :			• • • • •
Weight	: 300		Fall-over	:	No		
Confederation-Peers	: No						
Message statistics	Sent	Rcvd					
					2 •		
0	1	1					• • • • •
Open	1	1					• • • • •
Notification	0	0					
Updates	4	5					
Keepalives	76	78					
Route Refresh	0	0					
Total	81	84					
IOCAL	01	0 -					
		7.1.	anti-				
Capability		Adv	ertised Rec	ceivea	1		
Route Refresh		Yes	Yes	3			
Graceful Restart		Yes	Yes	5			
Add-Path		No	No				
Four Octet ASN		Yes	Yes	5			
Address family TPv4	Unicast	Ves	Ves	2			
Address family IIV4	Unicast	1CS	163	>			
Address lamily IPV6	UNICASL	NO	NO				
Address family L2VP	N EVPN	No	No				
Address Family : IP	v4 Unicast						
Rt Reflect Client	• No		Send Community	, .			
Allow-As in	• 0		Adut Intornal		30		
ATTOM-AD TH			Auvi, Incerval	- : 	50		
Max. Prefix	: 64000		Soft Reconfig	⊥n :			
Nexthop-Self	:		Default-Origin	nate :			
Cfg. Add-Path	:						
Neg. Add-Path	: Disable						
Pouteman In							
Routemap III	:						
Koutemap Out	·						
ORF type	: Prefix-list						
ORF capability	:						

Step #3: Verify BGP routes and ip routing table

L0 of SW1 (192.168.2.1) should be learnt in SW3 behind two eBGP peers and only the route through SW2 should be preferred.

BFD Lab1



Due to the higher weight of the BGP route learnt from the IP address of the peer circuit attached to the intermediate L2 switch, the path through this intermediate L2 switch is preferred in the routing table:

SW3											
SW3# show ip n	route										
						• • • • • • • • • •					
Displaying ipv	74 routes selected fo	r forwarding	· • • • • • •								
1 1 7 1		2		· • • • • • • • •		 .					
Origin Codes: C - connected, S - static, L - local											
Dirigin codes. C connected, 5 - Static, 1 - IOCal											
Turne Codea.	E Eutornal DCD I	- USFF Internal DCD				• • • • • • • • • •					
Type codes:	E - Excernar bor, i	- Incernal BGP,	V - VPN, EV - EVP								
	IA - OSPF internal a	rea, EI - OSPF	external type 1	• • • • • • •		 .	· · · · · · · ·				
	E2 - OSPF external t	ype 2									
VRF: default				• •							
				•							
Prefix	Nexthop	Interface	VRF(eqress)	Origin/	Distance/	Age	· · · · · · · ·				
	-			Tvpe	Metric	• • • • • • • • • • • •					
10 10 100 0/24	4 —	vlan100	_	C	[0/0]	<u>.</u>					
10 10 100 1/32	2 _	vlan100	_	T.	[0/0]	_ ` • • • • • • •					
10.10.100.1/32		vlan100	_		[20/0]	01d.03h.52m					
102 169 2 2/20	1 192.100.4.9	leephagk0		D/E		010.0511.521					
192.108.2.2/32	-	100pback0	-	L	[0/0]	-					
192.168.4.0/31	L —	1/1/8	-	C	[0/0]	-					
192.168.4.1/32	2 –	1/1/8	-	L	[0/0]	-					
192.168.4.8/29) –	vlan1105	-	С	[0/0]	-					
192.168.4.12/3	32 -	vlan1105	-	L	[0/0]	-					

Total Route Count : 8

Similarly, on SW1, the HostA subnet is preferred through the path of the intermediate L2 switch.

```
SW1
SW1# show bgp ipv4 unicast
Status codes: s suppressed, d damped, h history, * valid, > best, = multipath,
             i internal, e external S Stale, R Removed, a additional-paths
Origin codes: i - IGP, e - EGP, ? - incomplete
VRF : default
Local Router-ID 192.168.2.1
   Network
                      Nexthop
                                      Metric
                                                 LocPrf
                                                            Weight Path
* e 10.10.100.0/24
                      192.168.4.1
                                    0
                                                            200
                                                 100
                                                                    65002 ?
*>e 10.10.100.0/24
                      192.168.4.12
                                      0
                                                 100
                                                            300
                                                                    65002 ?
*> 192.168.2.1/32
                      0.0.0.0
                                      0
                                                 100
                                                            0
                                                                    ?
* e 192.168.2.2/32
                      192.168.4.1
                                                            200
                                                                    65002 ?
                                      0
                                                 100
*>e 192.168.2.2/32
                    192.168.4.12
                                      0
                                                 100
                                                            300
                                                                    65002 ?
Total number of entries 5
SW1# show ip route
Displaying ipv4 routes selected for forwarding
Origin Codes: C - connected, S - static, L - local
             R - RIP, B - BGP, O - OSPF
Type Codes:
             E - External BGP, I - Internal BGP, V - VPN, EV - EVPN
             IA - OSPF internal area, E1 - OSPF external type 1
             E2 - OSPF external type 2
VRF: default
```

		•			•	
Prefix	Nexthop	Interface	VRF(egress)	Origin/ Type	Distance/ Metric	Age
10.10.100.0/24	192.168.4.12	vlan1105		B/E	[20/0]	01d:03h:56m
192.168.2.1/32	-	loopback0	• • • <u>-</u> • • • • • • • • • • • •	Ľ	[0/0]	-
192.168.2.2/32	192.168.4.12	vlan1105	-	B/E	[20/0]	01d:03h:56m
192.168.4.0/31	-	1/1/8	· · · · · · · · · · · · · · · ·	• C • • • • •	• [0/0]•	-
192.168.4.0/32	-	1/1/8	• <u>•</u> • • • • • • • • • • • •	L	[0/0]	-
192.168.4.8/29	-	vlan1105	\ -	С	[0/0]	-
192.168.4.9/32	-	vlan1105		• L• • • • • •	• [0/0]••••	-
Total Route Count :	7		0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	• •	0 0)
					• • • • • • • • • •	
					•••••	

Step #4: Verify IP connectivity between HostA and SW1 Loopback0.

```
HostA
VPCS> ping 192.168.2.1
84 bytes from 192.168.2.1 icmp_seq=1 ttl=63 time=4.226 ms
84 bytes from 192.168.2.1 icmp_seq=2 ttl=63 time=4.424 ms
84 bytes from 192.168.2.1 icmp_seq=3 ttl=63 time=4.474 ms
84 bytes from 192.168.2.1 icmp_seq=4 ttl=63 time=3.991 ms
84 bytes from 192.168.2.1 icmp_seq=5 ttl=63 time=3.756 ms
```

Task 3 – Test resiliency without BFD

Let's perform a link failure of the main path, and check how long the traffic is interrupted before the backup path is established.

Step #1: Start pings from HostA to SW1 L0 until interrupted

```
HostA

VPCS> ping 192.168.2.1 -t

84 bytes from 192.168.2.1 icmp_seq=1 ttl=63 time=4.365 ms

84 bytes from 192.168.2.1 icmp_seq=2 ttl=63 time=4.259 ms

84 bytes from 192.168.2.1 icmp_seq=3 ttl=63 time=3.565 ms

84 bytes from 192.168.2.1 icmp_seq=4 ttl=63 time=4.276 ms

84 bytes from 192.168.2.1 icmp_seq=5 ttl=63 time=3.852 ms

84 bytes from 192.168.2.1 icmp_seq=7 ttl=63 time=3.852 ms

84 bytes from 192.168.2.1 icmp_seq=7 ttl=63 time=3.831 ms
```

Step #2: Modify VLAN ID on interface 1/1/9 of SW2 and check traffic interruption

SW2(config)#	
SW2(config)# interface 1/1/9 SW2(config-if)# vlan access 1	

<u>Note</u>: It can be a real scenario where the VLAN-ID on intermediate L2 switch is changed by mistake. There is no physical link transition and such event cannot be immediately detected by BGP without BFD.

Immediately after this change, you should see ICMP failures:

```
HostA

84 bytes from 192.168.2.1 icmp_seq=7 ttl=63 time=3.831 ms

84 bytes from 192.168.2.1 icmp_seq=8 ttl=63 time=5.068 ms

84 bytes from 192.168.2.1 icmp_seq=9 ttl=63 time=3.746 ms

84 bytes from 192.168.2.1 icmp_seq=10 ttl=63 time=4.111 ms

192.168.2.1 icmp_seq=11 timeout

192.168.2.1 icmp_seq=12 timeout

192.168.2.1 icmp_seq=13 timeout

192.168.2.1 icmp_seq=14 timeout
```

			• • •	• • • •		•										
		• • • •	• • •	• • • •		•										
) 	••••	•••	••••							B	FD L	.ab1			
								Co	nfiau	iratio	n an	d HA	test	:		
								•••								
192.168.2.1 icmp seq=15 timeout			• • •	• • • •		• • •										
192.168.2.1 icmp seg=16 timeout		• • • •	• • •	• • • •		• • •	4									
192.168.2.1 icmp seg=17 timeout				••••												
192 168 2 1 icmp seg=18 timeout							•••									
102 168 2 1 icmp seg=10 timeout																
102.168.2.1 icmp_seq=10 timeout			• • •			• • •	• • •									
192.108.2.1 ICmp_sed=20 timeout		• • • •	• • •	• • • •		• • •	• • •	•								
		• • • •	•••	• • • •			•••	• •								
192.168.2.1 icmp_seq=83 timeout																
192.168.2.1 icmp_seq=84 timeout	1000															
84 bytes from 192.168.2.1 icmp seq=85 ttl=63	time=2.043	ms•••														
84 bytes from 192.168.2.1 icmp seq=86 ttl=63	time=2.481	ms	• • •	• • • •		•••	•••	•••	• •	• •						
84 bytes from 192.168.2.1 icmp seg=87 ttl=63	time=2.715	ms	•••	• • • •			•••	•••	•••	• •	•					
84 bytes from 192,168,2,1 icmp seg=88 tt]=63	time=6.122	ms														
84 bytes from 192 168 2 1 icmp seq=89 $\pm\pm1=63$	time=2 920	ms								• •			• •			
94 bytes from 192.160.2.1 icmp_seq 09 cc1 03	+imo-3 013									• •						
04 bytes 110m 192.100.2.1 10mp_sed=90 tt1=03	CIME-3.013														 	
It should take about the BGP hold-time duration for the	alternate nath	to hec	ome	alact	od by	BG	5	•••	• •	• •	• • •		• • •	• • •	 • • •	
	alternate path		onic a	SCIECU	eu by	001										
Conclusion: without BED, this incident on the intermed	iata I 2 switch	creates	nia e	nifica	nt not	work	out	ane					/		 	
Conclusion. Walloat Dr D, alls includent on the internica		orcatod	u sig	micu	in not	won	(out	uge.							 	
			• •	• • • •	• • • •	• • •	• • •	• • •	• •	• •	• • •		• • •	• • •	 • • •	
			•	••••			•••			•••	•••		•••	•••	 	
Step #3: restore VI AN 1105 on interface 1/	1/9 of SW2			•						• •					 	
	1/3 01 0112									• •				• • •	 	
					- N • •	• • •	• • •	• • •	• •	• •	• • •		• • •	• • •	 	
Check that routing is back to nominal state.						•••	• • •	• • •	• • •	• •	• • •		• • •	• • •	 • • •	
-						•										
										• •					 	
Step #4 (optional): test bop fast-external-fa	allover								• •	• •				• • •	 	

Optionally, you can compare routing responsiveness in case of direct L3 circuit failure and test the effect of BGP fast-externalfallover, by inverting main and backup path. For this purpose, you can modify the weight of the backup-path to become the active path.

SW1(config)#	SW3(config)#
router bgp 65001	router bgp 65002
bgp router-id 192.168.2.1	bgp router-id 192.168.2.2
bgp fast-external-fallover	bgp fast-external-fallover
neighbor 192.168.4.1 remote-as 65002	neighbor 192.168.4.0 remote-as 65001
neighbor 192.168.4.1 <mark>weight 400</mark>	neighbor 192.168.4.0 <mark>weight 400</mark>
neighbor 192.168.4.12 remote-as 65002	neighbor 192.168.4.9 remote-as 65001
neighbor 192.168.4.12 weight 300	neighbor 192.168.4.9 weight 300
neighbor 192.168.4.12 timers 10 30	neighbor 192.168.4.9 timers 10 30

Proceed with "clear bgp *" on both SW1 and SW3 for the new weight value to take effect.

You can repeat the ICMP test and shutdown interface 1/1/8 <u>on both</u> SW1 and SW3. This interface shutdown must be executed on both SW1 and SW3 as <u>simultaneously as possible</u> (reminder: there is no link state follow-up if peer link is shutdown on the CX Simulator).

The duration for traffic rerouting should be minimum: below 1 or 2 seconds ICMP traffic interruption depending on how simultaneous is the interface shutdown executed on both SW1 and SW3.

Note: BFD is not needed for direct L3 circuit between two eBGP peers.

Restore previous weight value and restore interface 1/1/8 on both SW1 and SW3 if you ran this optional test.

Task 4 – Configure BFD for the eBGP session established over the L2 path

- BFD must be enabled globally.
- BFD is configured globally and not per interface.
 The BGP network-service will create the BFD session on the associated interface of the BGP peering.
- BFD must be configured on both ends (SW1 and SW3). If only one end is configured, the BFD state will stay down (instead of going through init, then up state).

- Echo loopback function is not available on CX Simulator.
- Proposed timers are the minimum value to obtain a reasonable failure detection time (1~2 seconds).

Step #1: Configure BFD globally

3 3 3 4 3	
SW1(config)#	SW3(config)#
bfd bfd min-receive-interval 500 bfd min-transmit-interval 500	bfd bfd min-receive-interval 500 bfd min-transmit-interval 500
bfd detect-multiplier 3	bfd detect-multiplier 3

Step #2: Configure BFD for eBGP session

		1 • •			
SW1(config)#	SW3(config)#	• •			
router bgp 65001	router bgp 65002				
bgp router-id 192.168.2.1	bgp router-id 192.168.2.2				
bgp fast-external-fallover	bgp fast-external-fallover	• •			
neighbor 192.168.4.1 remote-as 65002	neighbor 192.168.4.0 remote-as 65001				
neighbor 192.168.4.1 weight 200	neighbor 192.168.4.0 weight 200		/	/	
neighbor 192.168.4.12 remote-as 65002	neighbor 192.168.4.9 remote-as 65001 • • • • • • • •	• •		• • •	
neighbor 192.168.4.12 weight 300	neighbor 192.168.4.9 weight 300	•			
neighbor 192.168.4.12 timers 10 30	neighbor 192.168.4.9 timers 10 30		/	•••	
neighbor 192.168.4.12 fall-over bfd	<pre>neighbor 192.168.4.9 fall-over bfd</pre>	• •			

No need to clear the BGP session, the BFD session is created immediately.

Step #3: Verify BFD

Verify that BFD is set on the BGD session:

SW1			
SW1# show bgp ipv4 unica Codes: ^ Inherited from	ast neighbors 192.168 peer-group	.4.12	
VRF : default			
BGP Neighbor 192.168.4. Description	12 (External) :		
Peer-group	:		
Remote Router Id Remote AS Remote Port State Conn. Established Passive Cfg. Hold Time Neg. Hold Time Up/Down Time Local-AS Prepend BFD Password	: 192.168.2.2 : 65002 : 49390 : Established : 2 : No : 30 : 00h:20m:30s : No : Enabled :	Local Router Id Local AS Local Port Admin Status Conn. Dropped Update-Source Cfg. Keep Alive Neg. Keep Alive Connect-Retry Time Alt. Local-AS	: 192.168.2.1 : 65001 : 179 : Up : 1 : : 10 : 10 : 120 : 0
Last Err Sent Last SubErr Sent Last Err Rcvd Last SubErr Rcvd Graceful-Restart	: No Error : No Error : No Error : No Error : Enabled	Gr. Restart Time	: 120
Gr. Stalepath Time TTL Weight Confederation-Peers	: 300 : 1 : 300 : No	Remove Private-AS Local Cluster-ID Fall-over	: No : : No
Message statistics	Sent Rcvd		

				• • <th></th> <th>0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0</th> <th>RED Lab</th> <th>1</th>		0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	RED Lab	1
					•		Configuration and HA tes	l st
						• • • • • • • • • •	Configuration and the tes	51
				• • • • • • • • • • • • •	•	• • • • • • • • • • •		
	Open		2					
	Notification	0	0					
	Updates	7	6					
	Keepalives	148	149					
	Route Refresh	0	0				•	
	Total	157	157				0 K	
	Capability		Adve	ertised Receive	ed			
						==) 0 0 0 0 0 0 0 0 0 0 0	• • • • • •	
	Route Refresh		Yes	Yes				
	Add-Path		No	No	•			
	Four Octet ASN		Yes	Yes	•			
	Address family IPv4	Unicast	Yes	Yes				
	Address family IPv6	Unicast	No	No	•			
	Address family L2VPN	EVPN	No	No				
	Address Family : IPv	4 Unicast		• •	•			
	Rt. Reflect. Client	: No		Send Community	:	· · · · · · · · · · · · · · · · · · ·	• • • • • • • • • • • • • • • • • • •	
	Allow-AS in	: 0		Advt. Interval	:	30		
	Max. Prefix	: 64000		Soft Reconfig In	:	· · · · · · · · · · · · · · · · · · ·	• • • • • • • • • • • • • • • • • • •	
	Nexthop-Self	:		Default-Originate	:			
	Vig. Add-Path	· Disable				• • • • •	• • • • • • • • • • • • • • • •) • • • • • • • • •
	Ney. Aud-raufi	. DISADIE						
	Routemap In	:					· • • • • • • • • • • • • • • • • • • •	
	Routemap Out	:					* * * * * * * * * *	• • • • • • •
	ORF type	: Prefix-list						
	ORF capability	:						
040								
SW3‡ Code VRF	<pre># sh bgp ipv4 unicast es: ^ Inherited from : default</pre>	neighbors 192. peer-group	168.4.	9				
BGP	Neighbor 192.168.4.9 Description	(External)						
	Peer-group	:						
	Remote Router Id	: 192.168.2.1		Local Router Id	:	192.168.2.2		
	Remote AS	: 65001		Local AS	:	65002		
	Remote Port	: 179 . Established		Local Port	:	49390 Up		
	State Conn Established	• 1		Conn Dronned	:	0 0		
	Passive	: No		Update-Source	÷	0		
	Cfg. Hold Time	: 30		Cfg. Keep Alive	:	10		
	Neg. Hold Time	: 30		Neg. Keep Alive	:	10		
	Up/Down Time	: 00h:22m:42s		Connect-Retry Time	:	120		
	Local-AS Prepend	: No		Alt. Local-AS	:	0		
	Password	: Enabled						
	TUSSWOTU							
	Last Err Sent	: No Error						
	Last SubErr Sent	: No Error						
	Last Err Rcvd	: No Error						
	Last SubErr Rcvd	: No Error						
	Graceful-Restart	• Enabled		Gr Restart Time		120		
	Gr. Stalepath Time	: 300		Remove Private-AS	:	No		
	TTL	: 1		Local Cluster-ID	:	-		
	Weight	: 300		Fall-over	:	No		
	Confederation-Peers	: No						
	Market and the set	~						
	Message statistics	Sent R	cvd					
	0pen		1					
	Notification	0	0					
	Updates	4	2					

						 				BF	DLa	ab1			
						 		Con	figurati	on and	d HA	test			
					• • • •	 									
	150	150				 	•								
Keepalives	156	156			••••		•								
Route Refresh	0	0													
Total	161	159				 	• • •								
Capability		Adve	rtised	Receive	d	 • • •	• • •	4							
						••••	• • •	•							
Route Refresh		Yes		Yes											
Craceful Bostart		Voc		Voc		 		•••							
GIACEIUI RESLAIL		ies		ies		 									
Add-Path		NO		NO	• • • •	 		• • • •	• 🔬 👘						
Four Octet ASN		Yes	• • • •	Yes	• • • •	 • • •	• • •	• • • •	• • •						
Address family IPv4	Unicast	Yes		Yes	••••		• • •	••••							
Address family IPv6	Unicast	No		No											
Address family L2VPN	J EVPN	No		No		 					• •				
_			•			 									
Address Family : IPv	4 Unicast				• • • •	 ••••	• • •	• • • •	• • • •	• • •	• • •	• • •	••		
				• • • • •	• • • •	••••	• • •	• • • •	• • • •	•••	• • •	• • •	• •	•••	•••
Rt. Reflect. Client	: NO		Sena Commun	ıty 🖕	· • •	 							• •	• • •	
Allow-AS in	: 0		Advt. Inter	val 💧	: 30	 • • •	• • •	• • • •		• • •	• • •	• • •	• •	• • •	
Max. Prefix	: 64000		Soft Reconf	ig In	•••	 ••••	• • •	• • • •	• • • •	• • •	• • •	• • •	• •	•••	•••
Nexthop-Self	:		Default-Ori	ginate	:		•••								
Cfg. Add-Path	:														
Neg. Add-Path	: Disable					 									
						 							• •	• • •	
Pouteman In							• • •	• • • •	• • • •	• • •	• • •		• •	• • •	• • •
Reuteman Out	•					• •	• • •	• • • •	• • • •	•••	•••	• • •	•••	•••	•••
	• • • • • • • • • • • • • •														
окв туре	: Prelix-list														
ORF capability	:												• •		
										• • •	• • •		• •	• • •	
													• •		

Then verify BFD with various show bfd commands:

SW1											
SW1# <mark>sh</mark>	ow bfd s	summary									
Session	ns										
Admin 1	Down	Down	Init	Up	Total						
	0	0	0	1	1						
Total j	protocol	ls: 0									
SW1# <mark>sh</mark>	ow bfd										
Admin s Echo so Statist Total n Total n Total n	tatus: e urce IP: ics: umber of umber of umber of	enabled N/A contro contro contro	l packe l packe l packe	ts tra ts rec ts dro	nsmitted: eived: 10 oped: 0	101135 1088					
Session	Interfa	ace VRF	S	ource	IP		Destinati	on IP	Echo	State	Protocol
1	vlan110)5 defa	ult 1	92.168	.4.9		192.168.4	.12	N/A	up	bgp
SW1# <mark>sh</mark>	ow bfd s	session	1								
BFD ses	sion inf	Formatio	n - Ses	sion 1							

BFD session information - Session 1 VRF: default Min Tx interval (msec): 500 Min echo Rx interval (msec): 500 Detect multiplier: 3 Protocol(s): bgp Local discriminator: 4310 Remote discriminator: 13211 Echo: N/A



Note that the discriminator values reported by SW3 are the mirrored values of SW1.

Task 5 – Test resiliency with BFD

Step #1: Start pings from HostA to SW1 L0 until interrupted

```
HostA
VPCS> ping 192.168.2.1 -t
84 bytes from 192.168.2.1 icmp_seq=1 ttl=63 time=4.365 ms
84 bytes from 192.168.2.1 icmp_seq=2 ttl=63 time=4.259 ms
```

84 bytes from 192.168.2.1 icmp_seq=3 ttl=63 time=3.56 84 bytes from 192.168.2.1 icmp_seq=4 ttl=63 time=4.18 84 bytes from 192.168.2.1 icmp_seq=5 ttl=63 time=4.27	BFD Lab1 Configuration and HA test
84 bytes from 192.168.2.1 icmp_seq=6 ttl=63 time=3.85	52 ms
84 bytes from 192.168.2.1 1cmp_seq=/ tt1=63 time=3.83	51 ms
Sten #2: Modify VI AN ID on interface 1/1/9 of SW2	and check traffic interruption
	and check traine inten uption
SW2(config)#	
SW2(config)# interface 1/1/9	
SW2(config-if)# vlan access 1	\
nmediately after this change, you should see almost no ICMP fa	allure (no more than 1):
HostA	
84 bytes from 192.168.2.1 icmp seg=8 ttl=63 time=3.93	36 ms
84 bytes from 192.168.2.1 icmp seg=9 ttl=63 time=3.99	95 ms
34 bytes from 192.168.2.1 icmp seg=10 ttl=63 time=2.8	810 ms
84 bytes from 192.168.2.1 icmp seg=11 ttl=63 time=3.6	605 ms
84 bytes from 192.168.2.1 icmp_seq=12 ttl=63 time=3.4	430 ms
84 bytes from 192.168.2.1 icmp seg=13 ttl=63 time=4.0	012 ms
84 bytes from 192.168.2.1 icmp_seq=14 ttl=63 time=7.4	406 ms
84 bytes from 192.168.2.1 icmp_seq=15 ttl=63 time=4.1	186 ms
84 bytes from 192.168.2.1 icmp_seq=16 ttl=63 time=3.8	866 ms
84 bytes from 192 168 2 1 icmp seg=17 ttl=63 time=4 5	532 ms
192 168 2 1 icmp seg=18 timeout	
84 bytes from 192 168 2 1 icmp seg=19 ttl=63 time=4 0	061 ms
84 bytes from 192.168.2.1 icmp_seq=10 ttl=63 time=2.4	446 ms
03 DYCCD IIOM IJ2.IU0.2.I ICMP DE9-20 CLI-00 CIME-2.4	

84 bytes from 192.168.2.1 icmp_seq=22 ttl=63 time=3.593 ms 84 bytes from 192.168.2.1 icmp_seq=23 ttl=63 time=3.058 ms 84 bytes from 192.168.2.1 icmp_seq=24 ttl=63 time=3.174 ms It should take 1.5 second (3*500ms) to detect BGP BFD failure which tears down the BGP session to the "connect" state.

Step #3: Check status of BFD session and BGP session. Check routes.

Look at the status of BFD session as well as the effect on the BGP session.

84 bytes from 192.168.2.1 icmp_seq=21 ttl=63 time=2.482 ms

SW1					
SW1# show bfd session 1					
BFD session information - Session VRF: default Min Tx interval (msec): 1000 Min Rx interval (msec): 500 Min echo Rx interval (msec): 500 Detect multiplier: 3 Protocol(s): bgp Local discriminator: 4310 Remote discriminator: 0 Echo: N/A Local diagnostic: control_detect Remote diagnostic: no_diagnostic State flaps: 1 Interface Source IP	cion_time_expired Destination IP	State	Pkt Rx	Pkt Tx	Pkt drop
vlan1105 192.168.4.9	192.168.4.12	down	107331	107396	0
SW1# show bgp ipv4 unicast summa VRF : default BGP Summary Local AS : 65001	BGP Router Identifier	: 192.168.2.1			
Cfg. Hold Time : 180 Confederation Id : 0	Log Neighbor Changes Cfg. Keep Alive	: NO : 60			



Consequently, the alternate BGP routes already present in the BGP table are selected as best and populate the ip routing table:

SW1						
SW1# show ip route						
Displaying involvented conforwarding						
probraind th	va ioures serected i	or rorwarding				
Origin Codes: C - connected, S - static, L - local						
Type Codes.	R - RIP, B - BGP, O - OSPF					
Type codes.	IA - OSPF internal	area, El - OSPF	external type 1	V L IN		
	E2 - OSPF external	type 2				
WDE. dofault						
VRF: Gelauit						
Prefix	Nexthop	Interface	VRF(egress)	Origin/	Distance/	Age
				Туре	Metric	
10.10.100.0/2	4 192.168.4.1	1/1/8	-	B/E	[20/0]	00h:01m:20s
192.168.2.1/3	2 –	loopback0	-	L	[0/0]	-
192.168.2.2/3	2 192.168.4.1	1/1/8	-	B/E	[20/0]	00h:01m:20s
192.168.4.0/3	1 –	1/1/8	-	С	[0/0]	-
192.168.4.0/3	2 –	1/1/8	-	L	[0/0]	-
192.168.4.8/2	0	1 c c 110E		<u>.</u>	r o / o i	-
	9 =	Vianiius	-	C	[0/0]	
192.168.4.9/3	9 – 2 –	vlan1105 vlan1105	-	C L	[0/0]	-
192.168.4.9/3	9 – 2 –	vlan1105 vlan1105	1	C L	[0/0]	-
192.168.4.9/3	9 – 2 – ount : 7	vlan1105 vlan1105	2	C L	[0/0]	-
192.168.4.9/3 Total Route Co	9 – 2 – ount : 7	vlan1105 vlan1105	-	C L	[0/0]	-
192.168.4.9/3 Total Route Co SW3 SW3# show ip :	ount : 7	vlan1105 vlan1105	-	C L	[0/0]	-
192.168.4.9/3 Total Route Co SW3 SW3# show ip	ount : 7	vlan1105	-	C L	[0/0]	-
192.168.4.9/3 Total Route Co SW3 SW3# show ip Displaying ip	9 - 2 - ount : 7 route v4 routes selected f	vlan1105 vlan1105 or forwarding	-	C L	[0/0]	-

Origin Codes:	C - connected, S - s	static, L - loc	al		Configuration	BFD Lab1 on and HA test	
Type Codes:	R - RIP, B - BGP, O E - External BGP, I IA - OSPF internal a E2 - OSPF external t	- OSPF - Internal BGP area, E1 - OSPF type 2	, V - exter	VPN, EV - EVPN nal type 1	• . • . • • •		
VRF: default							
Prefix	Nexthop	Interface	VRF	(egress) Origin/ Di Type Me	istance/ A etric	.ge	
10.10.100.0/24		vlan100	_ ` `	C [0)/01 -		
10.10.100.1/32		vlan100	-)/0]		
192.168.2.1/32	192.168.4.0	1/1/8	-	B/E [2	20/0] 0	0h:00m:59s	• • .
192.168.2.2/32	2 –	loopback0	-	L[C	0/0]		
192.168.4.0/31	L –	1/1/8	-)/0]•••••		
192.168.4.1/32		1/1/8	-	L [C)/0] -	•••••	
192.168.4.8/29	9 –	vlan1105	-	С [С)/0] -	; .	
192.168.4.12/3	32 -	vlan1105	-	L [C)/0]	· • • • • • • • • •	• • • • • • • •
Total Boute Co	unt:8				• • • • • • • • •	• • • • • • • •	
iotar noute of	Surfe . O					· • • • • • • • • •	
				• • • • • •			••••••
					••••••	••••	<u></u>
Conclusion: with	BFD, this incident on the	e intermediate L2	switch h	has a minimum impact on the net	twork.		
				· · ·			•••••
						• • • • • • • •	• • • • • • •
							•••••
This is the end of	this lab.					• • • •	
	-						~ ~ • • • • •



Appendix – Reference Configurations

If you face issues during your lab, you can verify your configuration with the configuration extract listed in this section.

SW1		
hostname SW1		
!	N O O O O O O O O O O O O O O O O O O O	
bfd		
bfd min-receive-interval 500		
bfd min-transmit-interval 500		
bfd detect_multiplier 3	\ 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	
bid detect-maicipiter 5		
: 		
Vian i		
vlan 1105	· · · · · · · · · · · · · · · · · · ·	
description transit interco VLAN		
interface mgmt		
no shutdown		
ip dhcp		
interface 1/1/8		
no shutdown		
description link to SW3		
ip address 192.168.4.0/31		
interface 1/1/9		
no shutdown		,
description link to SW2		
ne routing		
no routing		
Vian access 1105		
interface loopback U		
ip address 192.168.2.1/32		
interface vlan 1105		
ip address 192.168.4.9/29		
!		
router bgp 65001		
bgp router-id 192.168.2.1		
bgp fast-external-fallover		
neighbor 192.168.4.1 remote-as 65002		
neighbor 192.168.4.1 weight 200		
neighbor 192.168.4.12 remote-as 65002		
neighbor 192 168 4 12 weight 300		
neighbor 192.168 / 12 timers 10.30		
neighbor $192.100.4.12$ fill-over hfd		
neighbor 192.100.4.12 lall-over bid		
address-family ipv4 unicast		
neighbor 192.168.4.1 activate		
neighbor 192.168.4.12 activate		
redistribute local loopback		
exit-address-family		

SW2

hostname SW2 ! vlan 1 vlan 1105 description transit interco VLAN interface mgmt no shutdown ip dhcp interface 1/1/1 no shutdown description link to SW3 no routing vlan access 1105 interface 1/1/9 no shutdown description link to SW1 no routing vlan access 1105 interface vlan 1105 ip address 192.168.4.11/29

BFD Lab1 Configuration and HA test

SW3	
hostname SW3	
!	
bfd	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
bfd min-receive-interval 500	
bfd min-transmit-interval 500	
bfd detect-multiplier 3	
!	
vlan 1,100	· • • • • • • • • • • • • • • • • • • •
vlan 1105	· · · · · · · · · · · · · · · · · · ·
description transit interco VLAN	
interface mgmt	` • • • • • • • • • • • • • • • • • • •
no shutdown	
ip dhcp	
interface 1/1/1	
no shutdown	· · · · · · · · · · · · · · · · · · ·
description link to HostA	• • • • • • • • • • • • • • • • • • • •
no routing	
vlan access 100	· · · · · · · · · · · · · · · · · · ·
Interiace 1/1/8	
no Snutdown	· · · · · · · · · · · · · · · · · · ·
in address 102 168 4 1/21	
$\frac{10}{1000000000000000000000000000000000$	* * * * * * * * * * * * * * * * * * * *
no shutdown	· · · · · · · · · · · · · · · · · · ·
description link to SW2	
no routing	
vlan access 1105	
interface loopback 0	
ip address 192.168.2.2/32	
interface vlan 100	
ip address 10.10.100.1/24	
interface vlan 1105	
ip address 192.168.4.12/29	
!	
ip prefix-list endpoint seq 10 permit 10.0.0	.0/8 le 32
! route-man connected-ban permit seg 10	
match ip address prefix-list endpoint	
!	
router bgp 65002	
bgp router-id 192.168.2.2	
bgp fast-external-fallover	
neighbor 192.168.4.0 remote-as 65001	
neighbor 192.168.4.0 weight 200	
neighbor 192.168.4.9 remote-as 65001	
neighbor 192.168.4.9 weight 300	
neighbor 192.168.4.9 timers 10 30	
neighbor 192.168.4.9 fall-over bfd	
address-family ipv4 unicast	
neighbor 192.168.4.0 activate	
neighbor 192.168.4.9 activate	
redistribute local loopback	
redistribute connected route-map con	nectea-pgp
exit-address-family	





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